Claims

1.   A device for analysing manual thumps applied to simulate pre-cordial thumps
for the treatment of a dysrhythmia of the heart of a patient,

5   the device comprising a sensor arrangement arranged to detect parameters of
a said manual thump.

2.   A device according to claim 1, wherein the sensor arrangement comprises at
least one sensor having a frequency response of at least 1 kHz.

10

3.   A device according to claim 1 or 2, wherein the sensor arrangement
comprises at least one sensor which produces an output signal representative of the
force applied to the sensor.

15 4.   A device according to claim 3, wherein the output of sensor arrangement is
proportional to the mechanical input.

5.   A device according to any one of the preceding claims, wherein the sensor
arrangement is arranged to detect parameters of a said manual thump having an

20 energy in the range from 1J to 20J.

6.   A device according to any one of the preceding claims, wherein the sensor
arrangement comprises at least one sensor which comprises:
        a support;

25   a member for receiving an applied force mounted for movement relative to
the support with a resilient arrangement having a preselected spring constant coupled
between the member and the support; and
        an optical sensor arranged to detect the displacement of the member relative
to the support.

30

7.   A device according to claim 6, wherein the optical sensor is fixed to one of
the support and the member, an optical grating being fixed to the other of the support

and the member positioned to be analysed by the optical sensor to detect the displacement of the member relative to the support.

8.   A device according to any one of the preceding claims, further comprising a
5   speed detector arrangement for detecting the pre-impact speed of the fist.

9.   A device according to claim 8, wherein the speed detector arrangement comprises at least two, spaced apart optical transmitter/receiver pairs for detecting passage of the fist.
10

10.   A device according to any one of the preceding claims, wherein the device has, in the target region for manual thumps, mechanical properties selected to simulate the precordial region of the chest of a patient.

15 11.   A device according to claim 10, further comprising a flexible sheet covering the sensor arrangement and having a resilience selected to simulate the precordial region of the chest of a patient.

12.   A device according to any one of the preceding claims, further comprising
20 analysis means for analysing the detected parameters according to predetermined criteria to classify the effectiveness of a manual thump.

13.   A device according to any one of the preceding claims, further comprising indicator means for outputting at least one of a visible or an audible indication of the
25 detected parameters.

14.   A device according to any of the preceding claims, wherein the sensor arrangement comprises an array of sensors.

30 15.   A device according to claim 14, wherein the array is a regular array.

16.   A device according to claim 14 or 15, wherein each sensor is covered by a

-23-

rigid cap for transmitting applied force to the respective sensor.

17.   A device according to any one of claims 14 to 16, further comprising an electronic circuit for receiving the output signal of each sensor.

5

18.   A device according to claim 17, wherein the electronic circuit comprises at least one analog-to-digital converter arranged to convert the output signals of the sensors into a digital signal.

10   19.   A device according to claim 18, wherein the electronic circuit further comprises at least one multiplexer arranged to time-division multiplex the output signals of a group of sensors before conversion by said at least one analog-to-digital converter.

15   20.   A device according to claim 19, comprising a plural number of multiplexers and analog-to-digital converters, each arranged to convert the output of a respective multiplexer.

21.   A device according to any one of the preceding claims, wherein the device
20   has an output port for transferring the output signals of the sensor arrangement.

22.   A combination of a device according any one of the preceding claims with a computer system arranged to receive the output signals of the sensor arrangement, the computer system having a computer program executable to process the output
25   signals of the sensor arrangement.

23.   A combination according to claim 22, wherein the computer program capable of deriving the work performed during the manual thump.

30   24.   A combination according to claim 22 or 23, wherein the computer program is capable of producing a graphical representation of the output signals of the sensors.

-24-

25.   A combination according to claim 24, wherein the computer program is capable of producing a graphical representation of any one or all of: the respective output signal of respective sensors over time; the combination of the output signals of all the sensors over time; and the output signals of the sensors in their relative

5   positions.

26.   A method of analysing a manual thump applied to stimulate a pre-cordial thump for the treatment of a dysrhythmia of the heart of a patient, comprising applying the manual thump to a device according to any one of claims 1 to 21 or a

10   combination according to any one of claims 22 to 25.

27.   A force-detecting sensor comprising:

a support;

a member for receiving an applied force mounted for movement relative to

15   the support with a resilient arrangement having a preselected spring constant coupled between the member and the support; and

an optical sensor for detecting the displacement of the member relative to the support, the detected displacement being representative of the applied force.

20   28.   A sensor according to claim 27, wherein the optical sensor is fixed to one of the support and the member, and an optical grating is fixed to the other of the support and the member in a position to be analysed by the optical sensor to detect the displacement of the member relative to the support.

25   29.   A computer program executable by a computer system and capable, when so executed, of causing the computer system to process the output signals of an array of sensors arranged to detect an impact applied thereto.

30.   A computer program according to claim 29, wherein the computer program is

30   capable of causing the computer system to produce a graphical representation of the output signals of the sensors.

31. A computer program according to claim 30, wherein the computer program is capable of causing the computer system to produce a graphical representation of any one or all of: the respective output signal of respective sensors over time; the combination of the output signals of all the sensors over time; and the output signals

5 of the sensors in their relative positions.

32. A device for analysing impacts, the device comprising a sensor arrangement for detecting parameters of an applied impact.

10 33. A device according to claim 32, wherein the sensor arrangement comprises at least one sensor having a frequency response of at least 1kHz.

34. A device according to claim 32 or 33, wherein the sensor arrangement comprises at least one sensor which produces an output signal representative of the

15 force applied to the sensor.

35. A device according to claim 34, wherein the output of the sensor arrangement is proportional to the mechanical input.

20 36. A device according to any one of claims 32 to 35, wherein the sensor arrangement is arranged to detect parameters of a said manual thump having an energy in the range from 1J to 20J.

37. A device according to any one of claims 32 to 36, wherein the sensor

25 arrangement comprises at least one sensor which comprises:

a support;

a member for receiving an applied force mounted for movement relative to the support with a resilient arrangement having a preselected spring constant coupled between the member and the support;

30 an optical sensor for detecting the displacement of the member relative to the support.

38.   A device according to claim 37, wherein the optical sensor is fixed to one of the support and the member, an optical grating being fixed to the other of the support and the member positioned to be analysed by the optical sensor to detect the displacement of the member relative to the support.

5

39.   A device according to any one of claims 32 to 37, further comprising a speed detector arrangement for detecting the pre-impact speed of the object making the impact.

10   40.   A device according to claim 39, wherein the speed detector arrangement comprises at least two, spaced apart optical transmitter/receiver pairs for detecting passage of the object making the impact.

41.   A device according to any one of claims 32 to 40, wherein the device has, in
15   the target region for an impact, mechanical properties selected to simulate the precordial region of the chest of a patient.

42.   A device according to claim 41, further comprising a flexible sheet covering the sensor arrangement and having a resilience selected to simulate the precordial
20   region of the chest of a patient.

43.   A device according to any one of claims 32 to 42, wherein the sensor arrangement comprises an array of sensors.

25   44.   A device according to claim 43, wherein the array is a regular array.

45.   A device according to claim 43 or 44, wherein each sensor is covered by a rigid cap for transmitting applied force to the respective sensor.

30   46.   A device according to any one of claims 43 to 45, further comprising an electronic circuit for receiving the output signal of each sensor.

47. A device according to claim 46, wherein the electronic circuit comprises at least one analog-to-digital converter arranged to convert the output signals of the sensors into a digital signal.

5   48. A device according to claim 47, further comprising at least one multiplexer arranged to time-division multiplex the output of a group of sensors before conversion by said at least one analog-to-digital converter.

49. A device according to claim 48, comprising a plural number of multiplexers
10   and the same number of analog-to-digital converters, each arranged to convert the output of a respective multiplexer.

50. A device according to any one of claims 46 to 49, wherein the device has an output port for transferring the output signals of the sensors.
15

51. A combination of device according to any one of claims 32 to 50 with a computer system arranged to receive the output signals of the sensor arrangement, the computer system having a computer program executable to process the output signals of the sensor arrangement.
20

52. A combination according to claim 51, wherein the computer program capable of deriving the work performed during the manual thump.

53. A combination according to claim 51 or 52, wherein the computer program
25   executable to produce a graphical representation of the output signals of the sensors.

54. A combination according to claim 53, wherein the computer program executable to produce a graphical representation of any one or all of : the respective output signal of respective sensors over time; the combination of the output signals
30   of all the sensors over time; and the output signals of the sensors in their relative positions.